Division of Air Quality Control

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING

DIVISION OF AIR QUALITY CONTROL

1979

AIR QUALITY DATA REPORT

ONE WINTER STREET - 8TH FLOOR
BOSTON, MASSACHUSETTS 02108

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EXECUTIVE SUMMARY

This Air Quality Report contains the air quality monitoring data for all Massachusetts Air Sampling Network sites operating in 1979. A site directory is included as well as figures showing air quality trends. The data contained herein has been compared with the National Ambient Air Quality Standards to determine compliance. The results of these comparisons of calendar year 1979 are summarized below. The Division of Air Quality Control (DAQC) utilizes these data in determining present and future regulatory actions, and to judge the success or failure of past actions.

Massachusetts is considered to be:

- in statewide violation of ozone (O_3);
- in violation of total suspended particulates (TSP) and Carbon Monoxide (CO) in specific communities;
- in statewide attainment for sulfur dioxide (SO_2) and nitrogen dioxide (NO_2).

The 1979 air quality monitoring data revealed:

TOTAL SUSPENDED PARTICULATES

Primary Standard (260 ug/m^3)

- one exceedance
  - Chicopee, private station (290 ug/m^3)

Secondary Standard (ug/m^3)

- one exceedance
  - Athol (202 ug/m^3)
  - Attleboro (166 ug/m^3)
  - Boston (192 ug/m^3)
  - Brookline (155 ug/m^3)
  - Chicopee, private station (184 ug/m^3)
  - Fall River, private station (234 ug/m^3)
  - Needham (186 ug/m^3)
  - Springfield, Taylor St. (156 ug/m^3)
  - Swansea, private station (185 ug/m^3)
  - Worcester, Narcus Store (157 ug/m^3)
  - Worcester, Health Dept. (162 ug/m^3)
- two exceedances
  - Chelsea (183 and 174 ug/m^3)
  - Holyoke (157 and 153 ug/m^3)
  - Pittsfield, West South Street (220 and 153 ug/
  - Springfield, Howard Street (151 ug/m^3)

- five exceedances

  - Chicopee, private station

Annual Secondary Standard (60 ug/m^3 - geometric mean)

- one exceedance

  - Chicopee, private station (69 ug/m^3)

NITROGEN DIOXIDE

Annual Arithmetic Mean (100 ug/m^3)

No exceedances were recorded during 1979

CARBON MONOXIDE

One-Hour Standard (35 ppm)

No exceedances were recorded during 1979

Eight-Hour Standard (9 ppm)

• one exceedance	Lowell (11.0 ppm)
• four exceedances	Boston, Kenmore Sq. (15.0 ppm)
• nine exceedances	Medford (20.1 ppm)
• twenty eight exceedances	Boston, Callahan Tunnel (15.5 ppm)

SULFUR DIOXIDE

Three-Hour Standard (500 ppb)

No exceedances were recorded during 1979

Twenty Four-Hour Standard (140 ppb)

• one exceedance	Lee, private station (160 ppb)

Annual Arithmetic Mean (30 ppb)

No exceedances were recorded during 1979

OZONE

One-Hour Standard (120 ppb)

- one day with exceedance(s) - Gardner
  - Pittsfield
  - Worcester
- two days with exceedance(s) - Greenfield
- three days with exceedance(s) Gloucester
- four days with exceedance(s) Attleboro
  - Charlton
  - Worcester
- five days with exceedance(s) Agawam
  - Medfield
  - Quincy
- six days with exceedance(s) - Amherst
  - Medford
- seven days with exceedance(s) Georgetown
  - Lincoln

MASSACHUSETTS' AIR QUALITY PROGRAM

The Commonwealth of Massachusetts has mandated that the Department of Environmental Quality Engineering (DEQE) attain and maintain both primary and secondary national ambient air quality standards (NAAQS) for six air pollutants. DEQE, to fulfill this responsibility, has established the Division of Air Quality Control (DAQC).

The primary goals of Massachusetts' air quality efforts are to:

1.) protect the public from the known or anticipated effects of air pollution;

2.) control the emission of hazardous pollutants into the atmosphere;

3.) attain and maintain Massachusetts and National primary (health) and secondary (welfare) ambient air quality standards;

4.) prevent airborne nuisance conditions which interfere with public comfort, safety, or convenience;

5.) enhance air quality to the extent possible consistent with other goals and programs (e.g. resource recovery, water quality management, coastal zone management) of the Commonwealth; and,

6.) ensure that measures to implement the NAAQS are effective, efficient, and economical.

There are currently six pollutants for which there are NAAQS. They are:

- Total Suspended Particulates (TSP),
- Sulfur Dioxide (SO_2),
- Carbon Monoxide (CO),
- Ozone (O_3),
- Nitrogen Dioxide (NO_2),
- Lead (pb).

These pollutants, except for lead*, are monitored statewide. Table I lists the five pollutants monitored in 1979 as well as their associat health and welfare effects. Table IA lists the state and national ambient air quality standards.

* Lead monitoring in Massachusetts will begin in January, 1982.

HEALTH AND WELFARE EFFECTS OF AIR POLLUTANTS

POLLUTANTS AND THEIR SOURCES	HEALTH EFFECTS	WELFARE EFFECTS
Ozone Product of reactions of motor vehicle exhaust, industrial process emissions and other fossil fuel combustion emissions, in the presence of sunlight.	Causes difficulty in breathing, especially when exercising, irritates eyes, may result in an increased susceptibility to respiratory infection.	Toxic to plants by causing both leaf damage and a decrease in growth. Can weaken materials such as rubber and fabrics.
Total Suspended Particulates Fossil fuel burning, industrial process emissions, motor vehicle exhaust, traffic movement over dusty roads.	Causes further distress to those with chronic lung diseases, can slter the lungs natural cleansing mechanism and can either be composed of or have toxic materials adhered to the surface	Causes soiling of materials, are corrosive and can damage buildings. In addition, causes haze which reduces visibility and the amount of solar energy reaching the earth.
Carbon Monoxide Internal combustion engines, fossil fuel combustion and cigarette smoking.	Reduces the blood's ability to carry oxygen which may cause heart and brain damage. Causes a decreased exercise capacity in those with angina pectoris. Also can cause slowed physical reactions, dizziness, fatigue and headache.	No known effect on materials or vegetation.
Sulfur Dioxide Combustion of fossil fuel	Irritation of throat and lungs and aggravation of symptoms among those with chronic lung diseases.	Corrosion and deterioration of metals, brittleness of paper, discoloration of paint and deterioration of fabric. Causes leaf damage to some plants.
Nitrogen Dioxide Emitted from motor vehicles and fossil fuel burning operations such as power plants as well as from chemical	Aggravation of symptoms in those with asthma and chronic bronchitis an increased susceptibility to respiratory infections and a decrease in lung	Fading of dyes, yellowing of leaves on plants, and changing the horizon to a reddish brown color.

TABLE IA

STATE AND NATIONAL AMBIENT AIR QUALITY STANDARDS

POLLUTANT	AVERAGING INTERVAL	PRIMARY STANDARD ug/m^3	PRIMARY STANDARD ppm	SECONDARY STANDARD ug/m^3	SECONDARY STANDARD ppm
Sulfur Dioxide	Annually	80	0.03	-	-
	24 hour	365	0.14	-	-
	3 hour	-	-	1,300	0.5
Particulate Matter	Annually	75	-	60	-
	24 hour	260	-	150	-
Carbon Monoxide	8 hour	10,000	9	10,000	9
	1 hour	40,000	35	40,000	35
Ozone	1 hour	240	0.12	240	0.12
Nitrogen Dioxide	Annually	100	0.05	100	0.05
Lead	3 month	1.5	-	1.5	-

ug/m^3 - micrograms per cubic meter
ppm - parts per million

THE AMBIENT AIR MONITORING PROGRAM

The responsibility of the ambient air monitoring program is to provide accurate and valid data to:

1.) ensure that state and national air quality standards are being met;

2.) establish background concentrations;

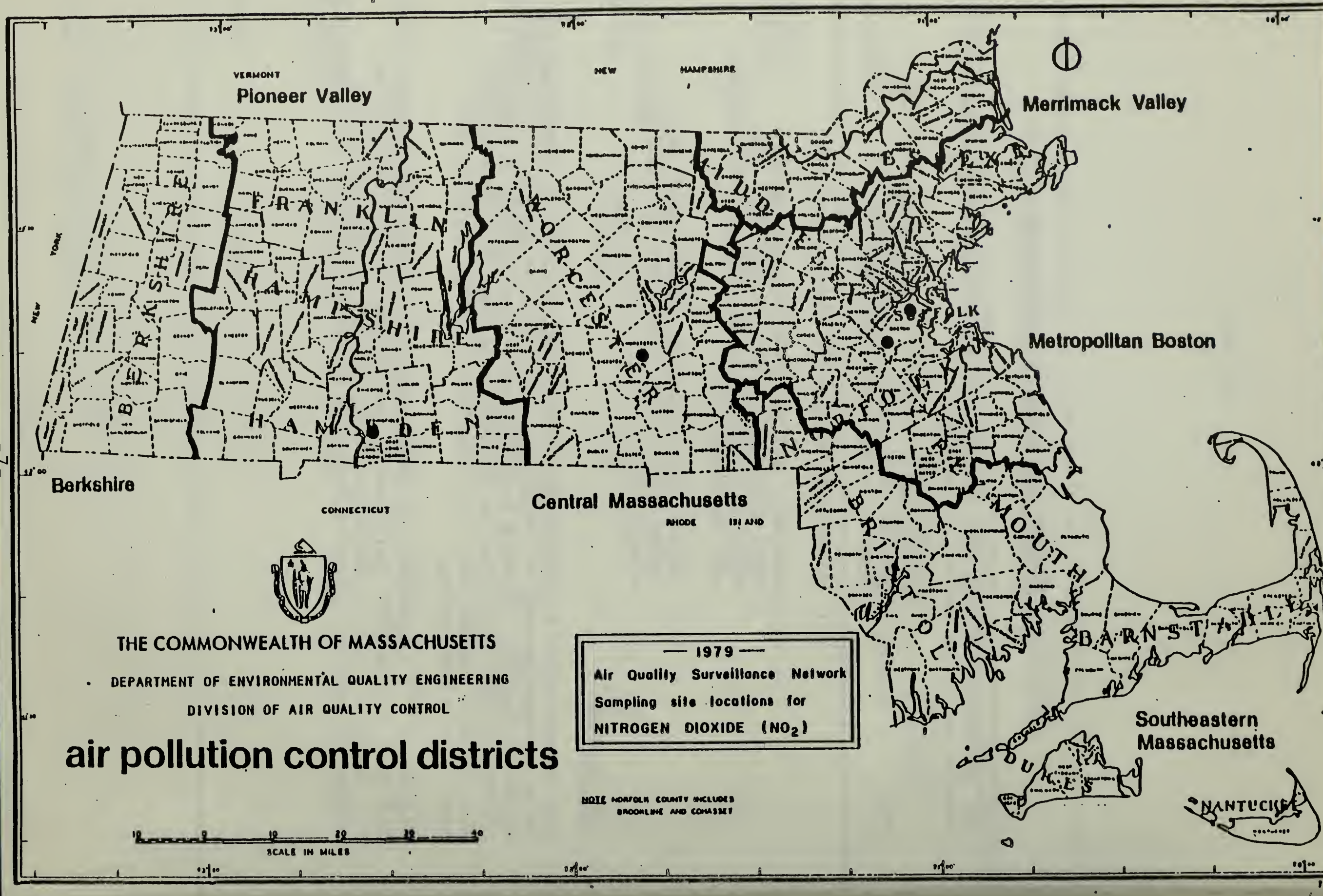
3.) evaluate air pollution trends which will allow the staff to evaluate the effects of air quality control regulations and programs; and,

4.) detect air pollution trends which may cause violations of ambient air quality standards.

THE NETWORK:

The Commonwealth's ambient air monitoring network is complemented by a private network of monitors. The private network - a result of Massachusetts allowing certain facilities to burn a higher sulfur content fuel than is otherwise allowed by Massachusetts air quality regulations - is limited to sulfur dioxide and particulate monitoring.

Figures 1 - 5 represent the Commonwealth's monitoring network, for each of the five pollutants, maintained by the Division of Air Quality Control (DAQC) in 1979. Figure 6 represents the number of samples taken by both the state and private networks.



THE COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING

DIVISION OF AIR QUALITY CONTROL

air pollution control districts

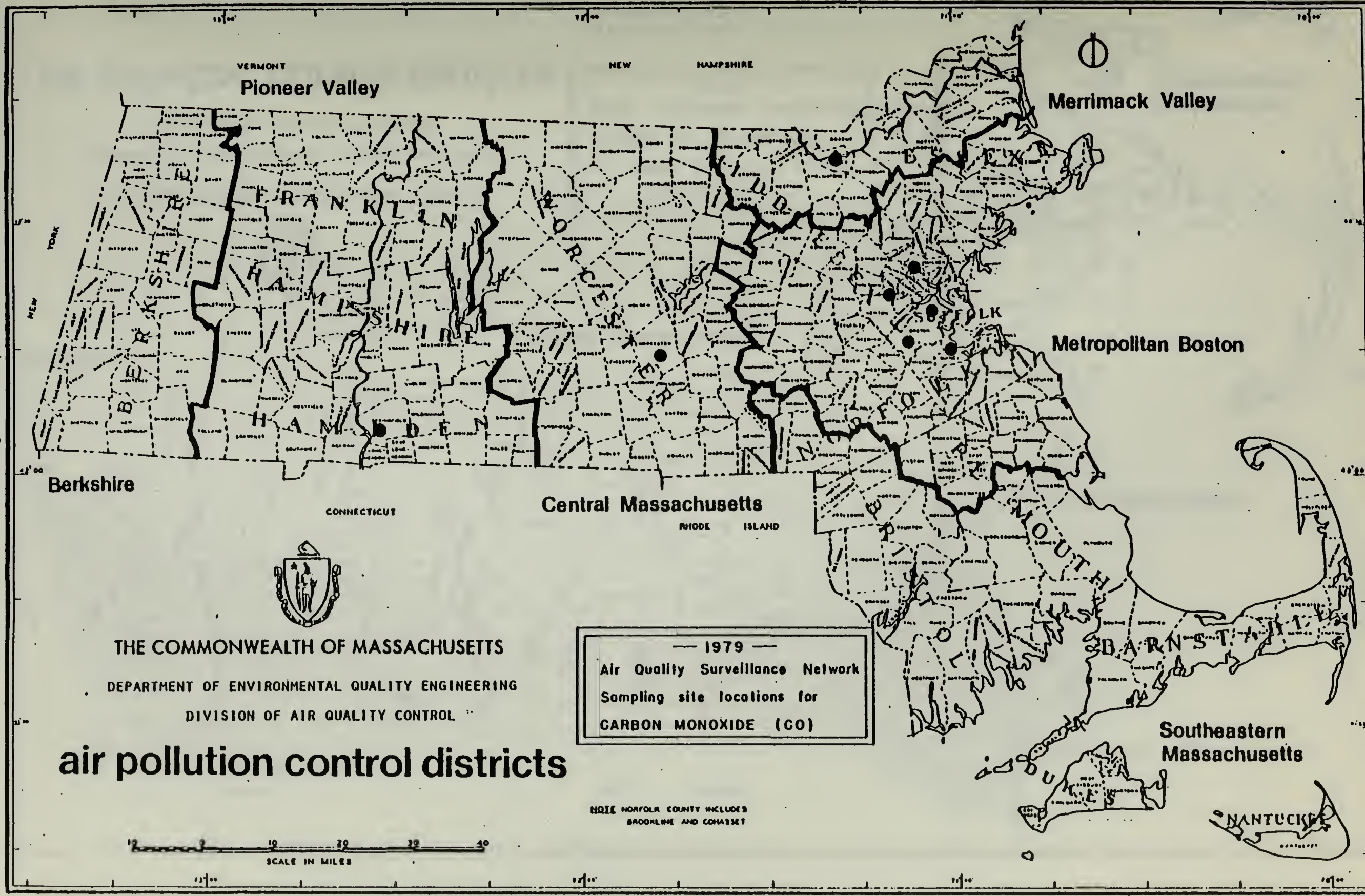
— 1979 —

Air Quality Surveillance Network

Sampling site locations for

NITROGEN DIOXIDE (NO_2)

NOTE NORFOLK COUNTY INCLUDES BROOKLINE AND CohASSET



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air pollution control districts

— 1979 —

Air Quality Surveillance Network

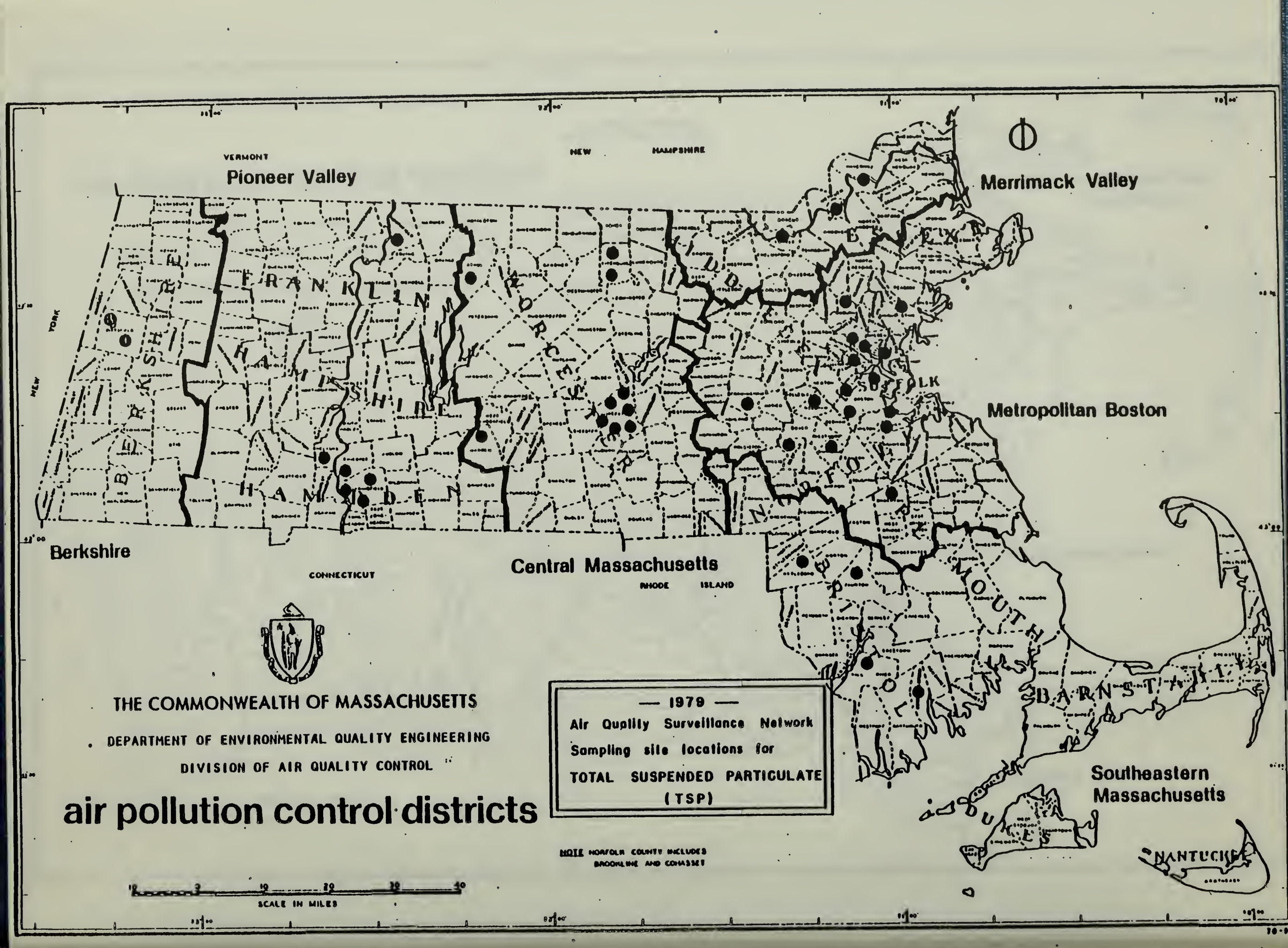
Sampling site locations for

CARBON MONOXIDE (CO)

NOTE NORFOLK COUNTY INCLUDES BROOKLINE AND COHASSET

0 5 10 20 30 40

SCALE IN MILES


VERMONT
NEW HAMPSHIRE
Pioneer Valley
Merrimack Valley
Metropolitan Boston
Berkshire
Central Massachusetts
Southeastern Massachusetts
CONNECTICUT
RHODE ISLAND
NEW YORK
FRANKLIN
HAMPSHIRE
HAMPDEN
WORCESTER
MIDDLESEX
ESSEX
NORFOLK
PLYMOUTH
BRISTOL
BARNSTABLE
DUKES
NANTUCKET
— 1979 —
Air Quality Surveillance Network
Sampling site locations for
TOTAL SUSPENDED PARTICULATE
(TSP)
NOTE NORFOLK COUNTY INCLUDES BROOKLINE AND CONNASSET
SCALE IN MILES
THE COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
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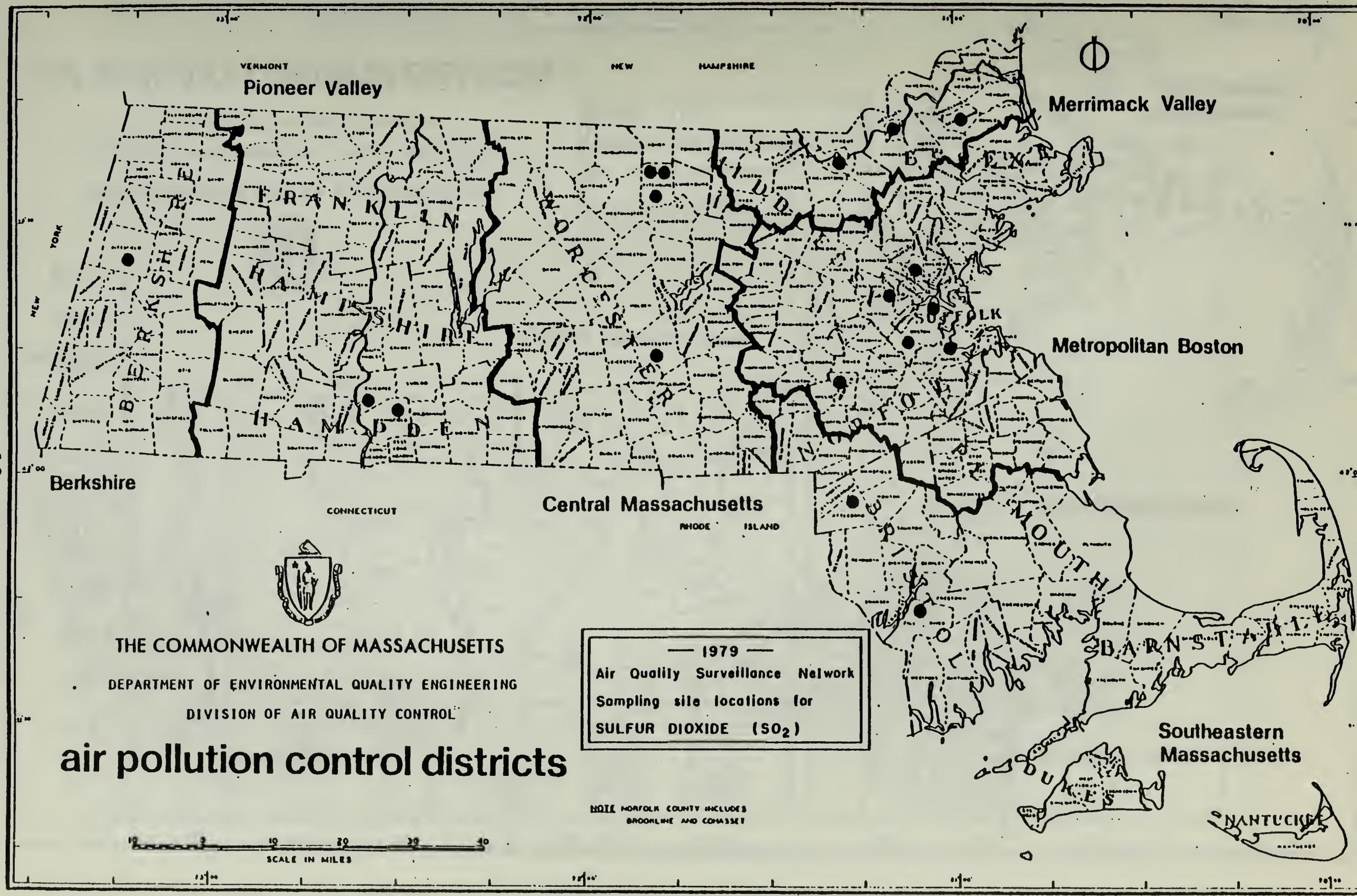

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air pollution control districts

— 1979 —

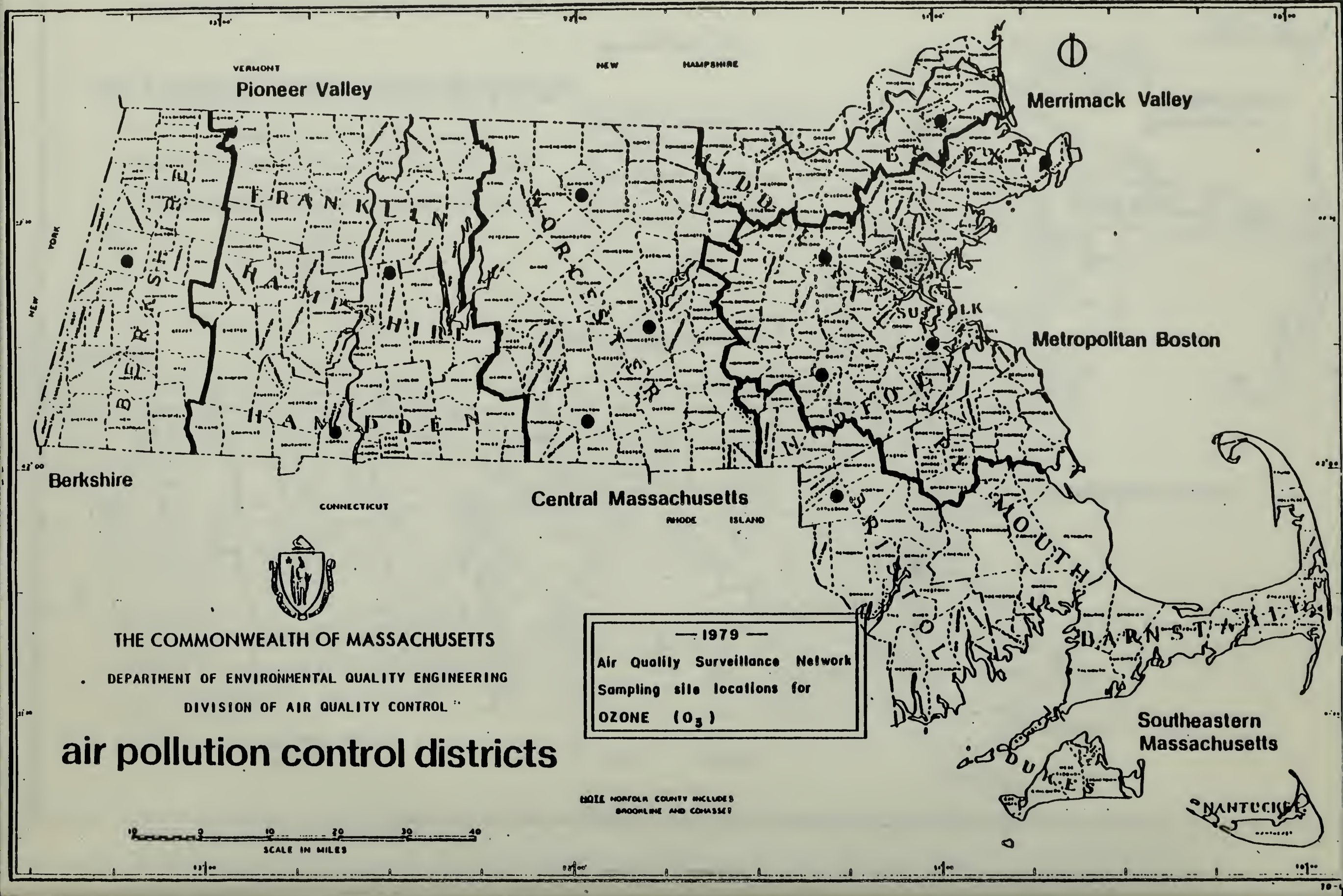
Air Quality Surveillance Network

Sampling site locations for

SULFUR DIOXIDE (SO_2)

NOTE NORFOLK COUNTY INCLUDES BROOKLINE AND COHASSET

SCALE IN MILES



THE COMMONWEALTH OF MASSACHUSETTS

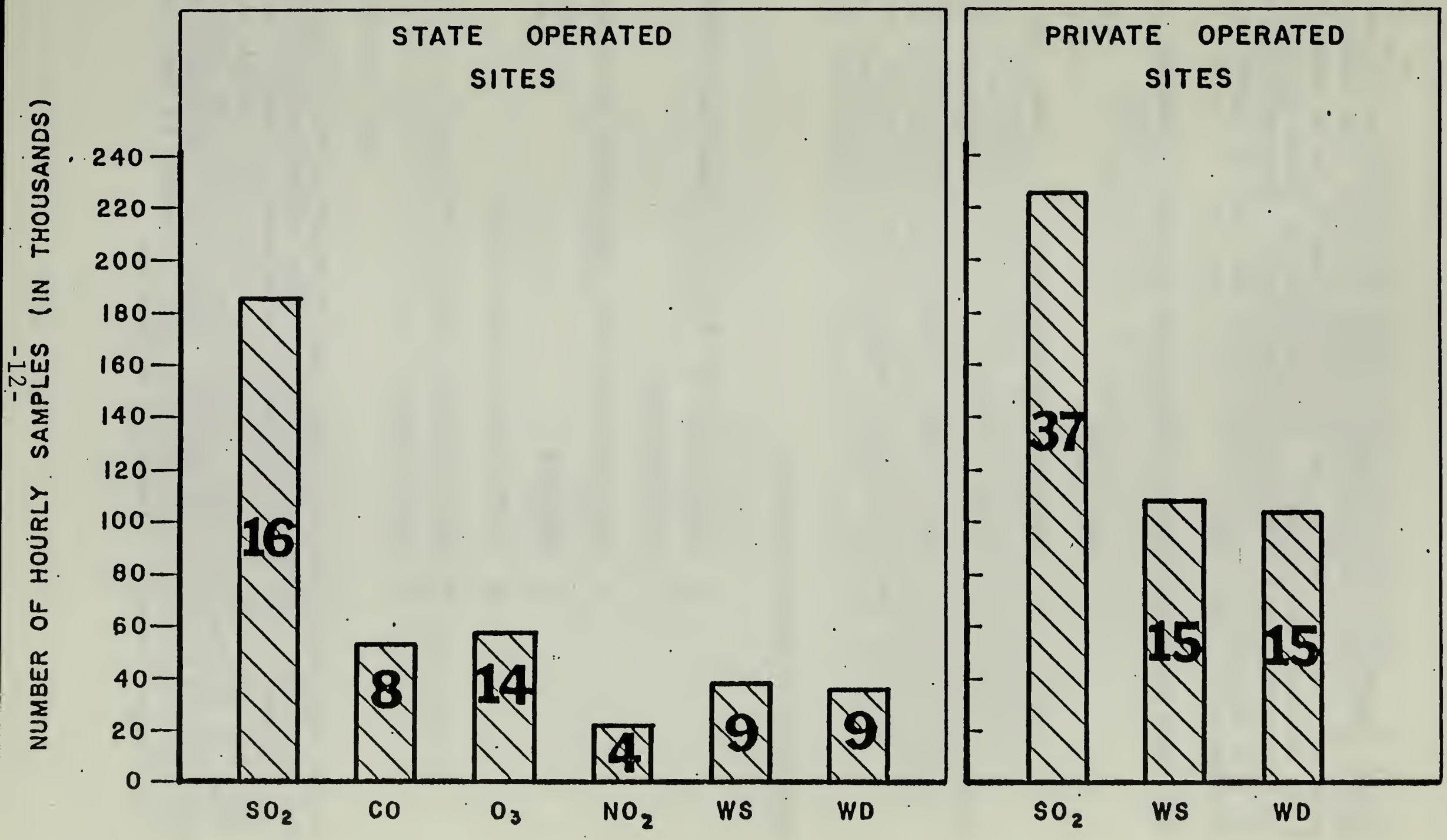
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING

DIVISION OF AIR QUALITY CONTROL

air pollution control districts

CONTINUOUS AIR SAMPLING NETWORK

1979



SO_2 - sulfur dioxide CO - carbon monoxide WS - wind speed WD - wind direction

Grand Total = 837,617 Hourly Samples

FIGURE 6

THE POLLUTANTS: 1979 Data and Trends

Total Suspended Particulates (TSP) are small particles of either solid or liquid matter which range in size from those visible, such as soot or smoke, to those too small to be seen without a high powered microscope. The largest of these particles remain in the atmosphere for only a few hours. The smallest can remain in the atmosphere for several days and can be carried great distances by the winds.

TSP have both natural and man-made sources. Natural sources include:

- the ocean,
- volcanic activity,
- forest fires,
- wind blown soils,
- biological activity.

Man-made sources include:

- combustion of fuel for heat and power,
- incinerators,
- manufacturing and industrial processes,
- warfare,
- fossil fuel power plants,
- agricultural activities,
- street dust.

Total suspended particulates may be organic or inorganic. Some may be metallic. Some may be toxic. The larger particulates, 15 to 90 micrometers, are not especially hazardous to health as thay are usually filtered out in the nose and throat. Particulates smaller than 15 micrometers are readily inhaled into the lungs and therefore constitute a threat to health. These small particulates can cause distress to those with chronic lung diseases as well as altering the lungs' natural cleansing mechanism.

Besides the health effects, particulates have welfare effects. Suspended particulates can:

- reduce the amount of sunlight reaching the earth,
- decrease visibility,
- increase haze and precipitation,
- soil cloth and paint,
- in the presence of some acidic gases, such as sulfur dioxide, particulate matter can accelerate the corrosion of metal.

The federal government - through the Environmental Protection Agency (EPA) - has established daily and annual TSP standards. In turn, these are divided into primary - to protect health - and secondary standards - to protect welfare. The EPA primary standard which is identical to Massachusetts TSP standard, gives a rough indication of the health hazard, since it does not separate toxic particles from those that are merely annoying. (Many studies indicate that particulates and sulfur oxides together increase the incidence and severity of respiratory disease.)

24 hour standard:	primary	260 ug/m^3
	secondary	150 ug/m^3
Annual standard: (geometric mean)	primary	75 ug/m^3
	secondary	60 ug/m^3

Table 2 contains a summary of the 1979 Massachusetts TSP data as recorded and verified by the Division of Air Quality Control.

Collection Method: TSP

All the TSP data are based on samples taken for 24 hours every six days by a "High Volume Sampler." This involves drawing air, for 24 hours, through an 8" by 10" glass fiber filter placed on a filter holder. Any suspended particulates will collect on the filter. The filters are retrieved from the monitoring stations and are sent to DEQE-DAQC's laboratory in Tewksbury. A routine gravimetric analysis on the filter is performed there.

Data Interpretation TSP

Massachusetts is considered to have had no violation of the TSP primary 24 hour standard during 1979.

Table 2 shows there were a number of exceedances of the secondary (welfare) 24 hour TSP standard (150 ug/m^3).

Athol
Attleboro
Boston
Brookline
*Chelsea
Chicopee
*Holyoke
Needham
*Pittsfield (West South Street)
Springfield (Taylor Street Fire Station)
Springfield (Howard Street)
Worcester (Narcus Department Store)

All of the above recorded at least one exceedance of the secondary 24 hour TSP standard. As previously explained, more than one exceedance is considered to be a violation. The three sites listed* above are in violation of the secondary 24 hour TSP standard. This means that the state and federal air pollution control officials consider these sites to be non-attainment areas for the secondary 24 hour TSP standard.

There were no violations of the primary annual TSP standard (geometric mean) - 75 ug/m^3.

Table 3 contains a summary of the 1979 Massachusetts air quality data recorded by the state's private monitoring network. These data reveal that one exceedance of the primary 24 hour standard (260 ug/m^3) was recorded at the Chicopee station. Chicopee also recorded five exceedances of the secondary TSP 24 hour standard (150 ug/m^3) during 1979. Based on this data, Chicopee is considered to be a non-attainment area for the secondary TSP 24 hour standard.

The Swansea station and one of the Fall River stations each recorded an exceedance of the secondary TSP 24 hour standard.

The private monitoring network did not record any exceedance of the primary TSP annual standard of 75 ug/m^3 during 1979.

TOTAL SUSPENDED PARTICULATES
State network data in ug/m^3

1979 DATA

SITE	ADDRESS	PERIOD	NUMBER OF OBSERVATIONS	MIN.	MAXIMUMS 1st.	2nd.	GEO. MEAN(75)	EXCEEDANCES Primary (260)	Secondar (150)
0100-001	Athol City Hall	1/1 - 12/29/79	56	14	202	127	46	0	1
0210-002	Attleboro South Main Street fire station	1/1 - 12/29/79	45	14	166	83	43	0	1
0240-012	Boston South Bay	1/1 - 12/29/79	58	32	192	117	67	0	1
0320-003	Brockton Maine School crescent st.	1/1 - 12/29/79	58	13	118	88	41	0	0
0340-001	Brookline High School	1/1 - 12/29/79	48	18	155	108	43	0	1
0360-001	Cambridge Harvard Herbarium	1/1 - 12/29/79	52	20	118	104	50	0	0
0380-002	Chelsea Fire head-quarters	1/1 - 12/11/79	49	5	183	174	63	0	2
0400-001	Chicopee								
0400-001	Chicopee City hall	2/1 - 12/29/79	49	22	184	109	60	0	1
0580-001	Fall River Central Fire Station	1/1 - 12/29/79	49	18	118	113	56	0	0
0620-004	Fitchburg Water St. fire station	1/1 - 12/29/79	58	11	113	111	46	0	0

TABLE 2
page II

TOTAL SUSPENDED PARTICULATES
State network data in ug/m^3

1979 DATA

SITE	ADDRESS	PERIOD	NUMBER OF OBSERVATIONS	MIN.	MAXIMUMS 1st.	MAXIMUMS 2nd.	GEO. MEAN(75)	EXCEEDANCES Primary (260)	EXCEEDANCES Secondar (150)
20-006	Fitchburg Gas & Electric Building	1/1 - 12/29/79	194	12	148	139	52	0	0
60-001	Framingham Middlesex County Courthouse	2/1 - 12/29/79	23	18	66	66	-	0	0
40-001	Haverhill Municipal Building	1/1 - 12/29/79	58	16	111	97	45	0	0
60-006	Holyoke Beaudry Boncher Apartments	1/1 - 12/29/79	58	16	157	153	60	0	2
00-003	Lawrence General Hospital	1/1 - 12/29/79	56	18	111	103	46	0	0
80-005	Lowell St. John's Hospital	1/1 - 12/29/79	54	17	128	117	55	0	0
00-001	Lynn City Hall	1/1 - 10/12/79	43	17	138	113	51	0	0
10-001	Medfield State Hospital	1/1 - 12/29/79	60	5	128	104	26	0	0

TOTAL SUSPENDED PARTICULATES
State network data in ug/m^3

1979 DATA

SITE	ADDRESS	PERIOD	NUMBER OF OBSERVATIONS	MIN.	MAXIMUMS 1st.	2nd.	GEO. MEAN(75)	EXCEEDANCES primary (260)	secondary (150)
1220-002	Medford fire head-quarters	1/1 - 12/29/79	50	25	122	119	55	0	0
1480-003	Needham Glover Memorial Hospital	1/1 - 12/29/79	45	16	186	85	37	0	1
1500-002	New Bedford High School	1/1 - 12/29/79	56	12	75	65	34	0	0
1652-001	Northfield Northfield School	1/1 - 12/29/79	43	11	114	101	32	0	0
1700-001	Norwood Nahatan st. fire station	1/1 - 12/29/79	52	15	136	94	44	0	0
1800-002	Pittsfield Hibbard School	1/1 - 12/29/79	55	9	133	132	50	0	0
1800-006	Pittsfield West South St.	1/1 - 5/21/79	16	15	220	153	-	0	2
1880-007	Quincy Atlantic fire station	1/1 - 12/29/79	50	23	132	107	45	0	0
1940-002	Revere Garfield High School	1/1 - 12/17/79	40	19	117	98	48	0	0

TOTAL SUSPENDED PARTICULATES
State network data in ug/m^3

1979 DATA

ITE	ADDRESS	PERIOD	NUMBER OF OBSERVATIONS	MIN.	MAXIMUMS 1st	2nd	GEO. MEAN (75)	EXCEEDANCES primary (260)	secondary (150)
60-002	Springfield Mill Street	1/1 - 12/29/79	58	25	141	137	60	0	0
60-003	Springfield Taylor St. fire station	1/1 - 12/29/79	60	23	156	140	61	0	1
60-011	Springfield Howard Street	1/1 - 12/31/79	325	10	151	140	58	0	1
40-001	Taunton Morton Hospital	1/1 - 12/29/79	58	11	98	91	37	0	0
72-001	Warren High School	1/1 - 12/29/79	57	11	100	79	31	0	0
20-002	Woburn Middlesex County Courthouse	1/1 - 12/29/79	56	17	123	108	46	0	0
40-004	Worcester Narcus Dept. store	1/1 - 12/14/79	194	14	157	149	51	0	1
40-008	Worcester Clark University	1/1 - 12/29/79	59	12	124	94	42	0	0
40-009	Worcester Parker Building	1/1 - 12/29/79	58	13	102	92	42	0	0

TOTAL SUSPENDED PARTICULATES
State network data in ug/m^3

1979 DATA

SITE	ADDRESS	PERIOD	NUMBER OF OBSERVATIONS	MIN.	MAXIMUMS 1st.	2nd.	GEO. MEAN(75)	EXCEEDANCES primary (260)	secondar (150)
2640-011	Worcester Quinsigamond College	1/1 - 12/29/79	60	10	129	88	37	0	0
2640-013	Worcester Health Dept.	1/1 - 12/23/79	59	11	162	143	52	0	1

TABLE 3

TOTAL SUSPENDED PARTICULATES
Private network data in ug/m^3

1979 DATA

SITE	ADDRESS	PERIOD	NUMBER OF OBSERVATIONS:	MIN.	MAXIMUMS 1st.	2nd.	GEO. MEAN(75)	EXCEEDANCES Primary (260)	Secondar (150)
40-018	Boston	1/1 to 12/29/79	59	23	127	112	56	0	0
40-019	Boston	1/1 - 12/29/79	56	13	81	81	27	0	0
40-020	Boston	1/1 - 12/29/79	59	16	105	88	37	0	0
40-021	Boston	1/1 - 12/29/79	59	17	115	103	46	0	0
00-006	Chicopee	1/1 - 10/30/79	48	16	290	217	69	1	5
80-001	Danvers	1/1 - 12/31/79	51	18	117	110	45	0	0
80-003	Danvers	1/1 - 11/21/79	33	20	121	103	56	0	0
80-007	Fall River	1/1 - 12/31/79	48	18	234	141	52	0	1
80-009	Fall River	9/1 - 12/31/79	64	15	108	80	46	0	0
80-012	Fall River	1/1 - 12/29/79	60	10	98	81	35	0	0
20-007	Fitchburg	2/1 - 12/23/79	56	9	83	83	35	0	0
20-008	Fitchburg	2/1 - 12/23/79	51	7	84	71	29	0	0
20-009	Fitchburg	2/1 - 12/29/79	48	12	128	125	57	0	0
00-003	Lynn	2/1 - 12/24/79	17	27	92	75	50	0	0
00-001	Northampton	1/1 - 10/30/79	49	15	143	118	53	0	0
80-002	Salem	2/1 - 12/31/79	49	19	97	85	41	0	0
80-003	Salem	1/1 - 12/31/79	175	17	136	112	47	0	0

TOTAL SUSPENDED PARTICULATES
Private network data in ug/m^3

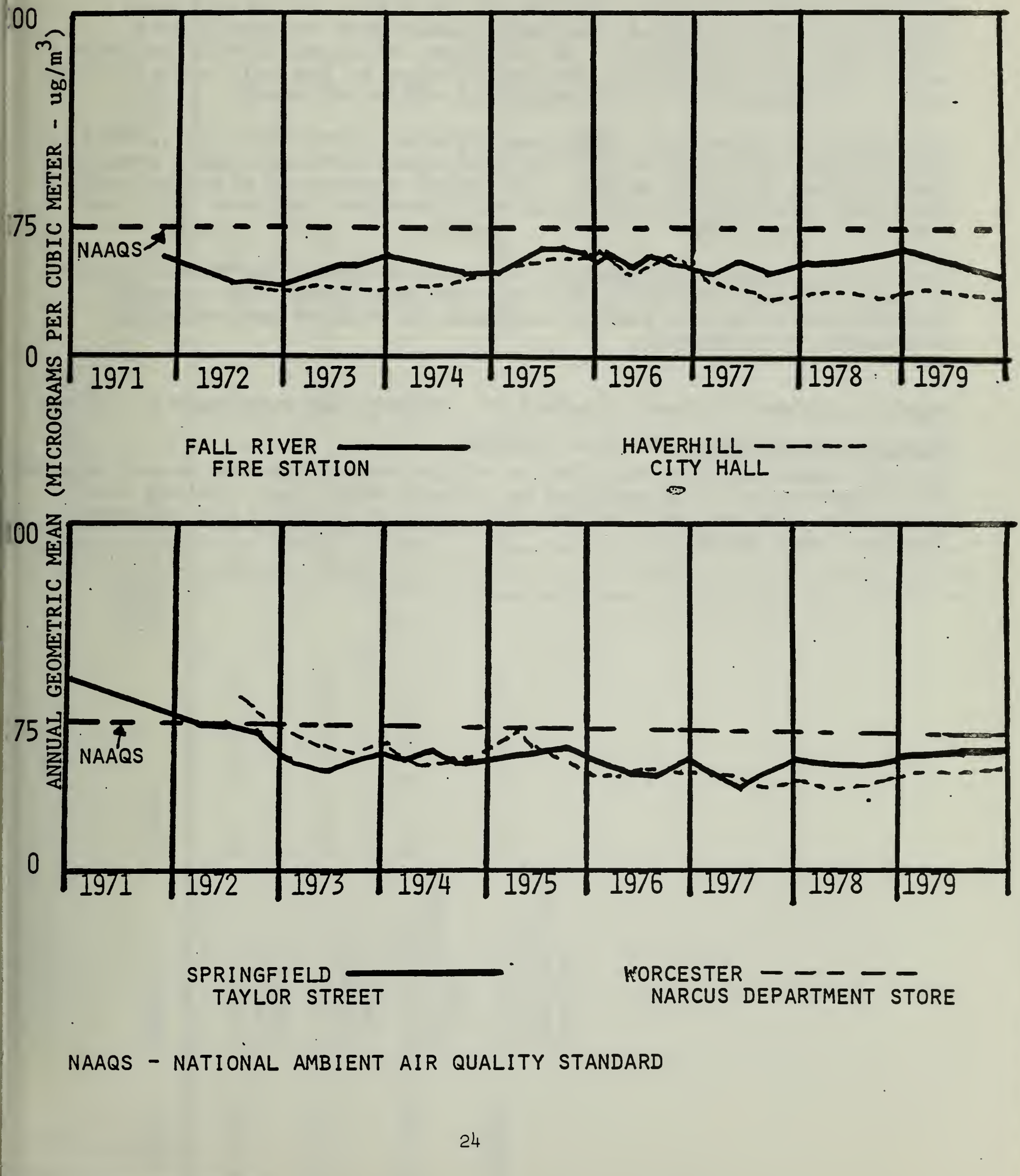
1979 DATA

SITE	ADDRESS	PERIOD	NUMBER OF OBSERVATIONS:	MINS.	MAXIMUMS 1st.	2nd.	GEO. MEAN(75)	EXCEEDANCES Primary (260)	Secondar (150)
042-001	Sherborn	1/1 - 11/29/79	55	10	132	129	28	0	0
160-009	Springfield	1/1 - 10/30/79	49	24	112	101	51	0	0
160-012	Springfield	1/1 - 10/25/79	283	10	136	129	49	0	0
160-013	Springfield	1/1 - 10/30/79	49	22	136	125	56	0	0
230-001	Swansea	1/1 - 12/31/79	77	10	185	73	32	0	1
420-001	Wellesley	6/1 - 12/29/79	33	5	70	55	28	0	0

Figure 7 reflects the trend of the TSP data from 1971 to 1979. The levels appear to be stabilizing at the stations tracked during this period. The trends reflect the success the Commonwealth has had in developing and enforcing TSP control strategies.

TOTAL SUSPENDED PARTICULATES (TSP)

ANNUAL GEOMETRIC MEANS-RUNNING AVERAGES
MASSACHUSETTS AIR SURVEILLANCE NETWORK (MASN)



NAAQS - NATIONAL AMBIENT AIR QUALITY STANDARD

Nitrogen Dioxide (NO_2) is a suffocating, reddish-orange-brown gas with a pungent odor. It is a strong oxidizing agent, quick to react with water vapor to form corrosive nitric acid. Occupational health studies have shown that nitrogen dioxide can be fatal at high concentrations. At lower levels nitrogen dioxide can irritate the lungs, cause bronchitis and pneumonia, and lower resistance to respiratory infections like influenza. In addition, nitrogen dioxide corrodes metal, injures vegetation, and contributes to the acid rain problem and to the formation of photochemical oxidants (smog).

When fuel is burned at a high temperature, above 650° C (1,200° F), the abundant nitrogen in the air will react forming highly reactive gases called nitrogen oxides. Principal sources of nitrogen oxide emissions are electric utilities and industrial boilers (56%), and transportation (40%).

The United States Environmental Protection Agency has established nitrogen dioxide standards for only one averaging time: yearly. In addition to only a yearly standard, the primary and secondary standards are identical.

Annual arithmetic mean standard: primary and secondary 50 ppb

Data Interpretation: Nitrogen Dioxide

In 1979 Massachusetts recorded no violations of the NO_2 annual standard. The Commonwealth is classified as a state which has attained and maintained the national ambient air quality standard for nitrogen dioxide. (see Table 4)

NITROGEN DIOXIDE
State data in ppb

SITE	ADDRESS	PERIOD	NUMBER OF OBSERVATIONS	MAXIMUMS 1st	2nd	3rd	ARITHMETIC MEAN	EXCEEDANCES
0240-002	Boston Kenmore Square	2/8 - 12/26/79	4,293	210	210	210	42	0
0240-016	Boston Callahan Tunnel	1/23 - 12/31/79	5,979	210	200	193	48	0
2160-005	Springfield East Columbus Street	1/1 - 7/31/79	4,777	220	175	140	42	0
2640-012	Worcester Washington and New Salem Streets	1/1 - 12/31/79	7,179	285	190	188	25	0

Carbon Monoxide (CO) is a colorless, odorless gas. It is formed as a result of incomplete combustion. Natural sources of carbon monoxide include forest fires and the respiration of mature plant leaves and plankton. The primary man-made source of CO is the internal combustion engine.

Carbon monoxide is by far the most plentiful air pollutant. EPA estimates that more than 102 million metric tons of CO are released into the air each year in the United States of America. (A metric ton is 1,000 kilograms, or about 2,200 pounds.)

Fortunately, this deadly gas does not persist in the atmosphere. It is converted by natural processes to harmless carbon dioxide, in ways not yet understood, fast enough to prevent any general buildup of CO. But CO can reach dangerous levels in localized areas, such as in city street canyons with heavy auto traffic and little wind. More than 95% of the CO emitted in the U.S.A. comes from road vehicles.

Clinical experience with accidental CO poisoning has shown clearly how it affects the body. When the gas is breathed, CO replaces oxygen in the red blood cells, reducing the amount of oxygen that can reach the body cells and maintain life. Lack of oxygen affects the brain, and the first symptons are impaired perception and thinking. Reflexes are slowed, judgment weakened, and a person becomes drowsy. An auto driver breathing high levels of carbon monoxide is more likely to have an accident; an athlete's performance and skill drop suddenly. Lack of oxygen then affects the heart. Death can come from heart failure or general asphyxiation, if a person is exposed to very high levels of carbon monoxide.

The federal government, through the Environmental Protection Agency, has established CO standards for two averaging times: 8-hour and 1-hour. The primary and secondary CO standards are identical.

1-hour standard:	primary and secondary	35 ppm
8-hour standard:	primary and secondary	9 ppm

Table 5 contains a summary of the 1979 Massachusetts carbon monoxide data recorded by the Division of Air Quality Control (DAQC) monitoring network.

Data Interpretation: Carbon Monoxide

During 1979 there were no exceedances[1] of the 1-hour standard recorded in Massachusetts. Exceedances of the 8-hour standard were recorded at Boston, Lowell and Medford air monitoring stations. The Callahan Tunnel (Boston) reported the highest number of 8-hour exceedances (28). Wellington Circle (Medford) recorded the highest level of CO (20.1 ppm).

The Medford and two Boston stations have recorded violations of the 8-hour CO standard. The Commonwealth, in an effort to attain the 8-hour CO standard is implementing a number of transportation control strategies. In November of 1979 the Governor signed, into law, the authorization to establish, by January 1, 1982, an automobile inspection and maintenance program. This program requires that all motor vehicles - less than 5,000 pounds and less than 15 years old - have an annual inspection of their emissions. If the vehicle fails the inspection (by emitting excessive levels of pollutants from the tailpipe) then the owner must have maintenance/repair work performed in order to bring the vehicle into compliance.

Figure 8 shows that a remarkable amount of progress has been made since 1973 towards reducing the CO levels in Massachusetts. It is hoped that the inspection and maintenance program, together with other transportation control strategies developed by the state and regional planning agencies, will eliminate the remaining 8-hour CO violations.

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1 An exceedance does not automatically mean that a violation of the air quality standards has occurred. The Clean Air Act allows one exceedance of the air quality short term standard to be recorded each year at each monitoring station. Anything beyond the first exceedance is considered to be a violation of the standard.

TABLE 5

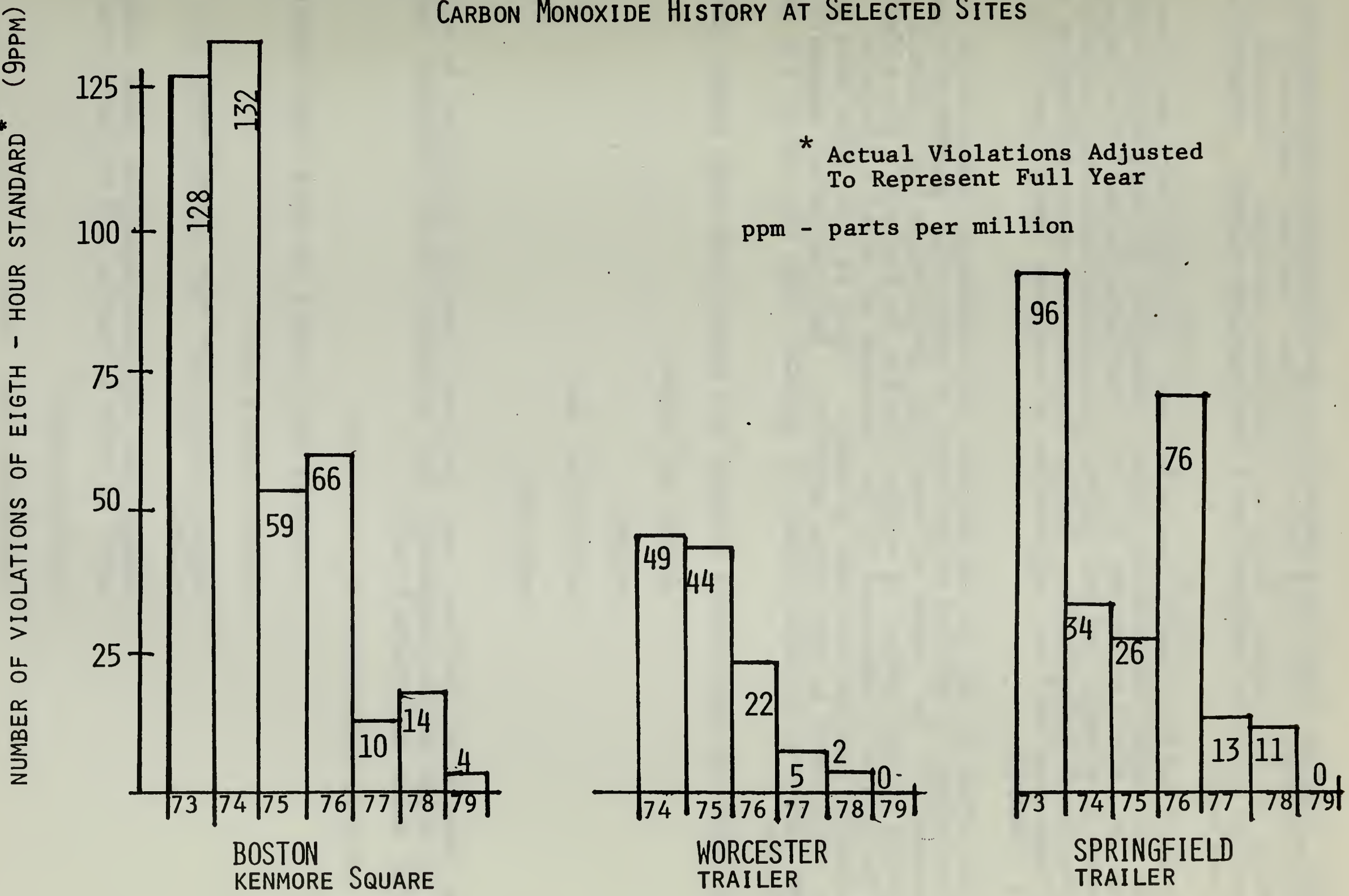
CARBON MONOXIDE (CO)
State network data in ppm

1979 DATA

SITE	ADDRESS	PERIOD	NUMBER OF OBSERVATIONS	ONE HOUR MAXIMUM 1st	ONE HOUR MAXIMUM 2nd	ONE HOUR EXCEEDANCES OVER 35PPM	EIGHT HOUR MAXIMUM 1st	EIGHT HOUR MAXIMUM 2nd	EIGHT HOUR EXCEEDANCES OVER 9 PPM
240-002	Boston Kenmore Square	1/1-12/31/79	8098	20	17	0	15.0	14.4	4
240-016	Boston Callahan Tunnel	1/1 - 12/31/79	6517	25	25	0	15.5	15.3	28
080-004	Lowell John Street Municipal Garage	1/1 - 12/31/79	6433	30	16	0	11.0	9.0	1
220-003	Medford Wellington Circle	1/1 - 12/31/79	6900	25	20	0	20.1	17.8	9
880-002	Quincy Fore River Bridge	1/1 - 12/31/79	6673	12	10	0	8.5	7.5	0
160-005	Springfield East Columbus Avenue	1/1 - 12/31/79	8410	18	15	0	9.0	8.9	0
380-005	Watertown Victory Field	1/8 - 12/31/79	2617	11	11	0	9.0	7.3	0
640-012	Worcester Washington and New Salem Streets	1/1 - 12/31/79	8281	13	11	0	7.4	7.4	0

FIGURE 8

CARBON MONOXIDE HISTORY AT SELECTED SITES



Sulfur Dioxide (SO_2) is a colorless, nonflammable, odiferous gas with corrosive qualities. The only significant natural sources of sulfur dioxide are biological decay and volcanic activity. Man-made sources of sulfur dioxide include fossil-fueled power plants, industrial processes and smelters.

By itself sulfur dioxide is a relatively mild irritant that does not travel below the upper respiratory tract. However, in combination with inhalable particles, which may carry SO_2 into the lower part of the lungs, SO_2 is much more toxic and may cause respiratory ailments, particularly in sensitive individuals. Sulfur dioxide may cause irritation of throat and lungs, as well as, aggravation of symptoms among those with chronic lung diseases.

As the level of SO_2 in the ambient air increases, there is an obstruction of breathing; a choking effect that doctors call "pulmonary flow resistance." The amount of breathing obstruction has a direct relation to the amount of sulfur dioxide in the air. The effect of SO_2 pollution is enhanced by the presence of other pollutants, especially particulates and oxidants. That is, the harm from two or more pollutants is more than additive. Each pollutant augments the other, and the combined effect is greater than the sum of the parts would be.

Many types of respiratory disease are associated with sulfur dioxide:

- coughs and colds,
- asthma,
- bronchitis, and
- emphysema.

Some researchers believe that the harm from SO_2 pollution is mainly due to other sulfur compounds that accompany sulfur dioxide, such as, sulfur acids and sulfate salts.

The welfare effects of SO_2 includes:

- increased acid levels in rain (acid rain),
- reduced crop yield,
- reduced visibility when transformed into particula sulfate,
- damaged and corroded materials (when combined with water to form sulfurous and sulfuric acid),
- brittled paper,
- discolored paint, and
- deteriorated fabric.

The federal and state sulfur dioxide standards are:

3-hour standard:	500 ppb*
24-hour standard:	140 ppb
Annual arithmetic mean standard:	30 ppb

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* ppb - parts per billion

Data Interpretation: Sulfur Dioxide

As with TSP, the Division of Air Quality Control's SO_2 monitoring network is complemented by an air quality monitoring network maintained by Massachusetts private industry. DAQC rigorously audits the private network to assure the validity of the data.

Table 6 shows that in 1979 the state monitoring network recorded no exceedances of the 3-hour, the 24-hour, or of the annual SO_2 standard.

Table 7 shows that the private network recorded one exceedance of the SO_2 annual standard at a monitoring station in Lee.

SULFUR DIOXIDE (SO_2) — 1979 DATA

state network data in ppb

SITE	ADDRESS	PERIOD	NUMBER OF OBSERVATIONS	MAXIMUMS 1-hr.	MAXIMUMS 3-hr	MAXIMUMS 24-hr	ARITHMETIC MEAN	EXCEEDANCES 3-hr. over 500ppb	EXCEEDANCES 24-hr. over 140pp
1880-002	Quincy Fore River Bridge	1/1-12/31	7330	111	106	68	12	0	0
2160-005	Springfield East Columbus Street	1/1-12/31/79	7421	92	77	49	12	0	0
2380-005	Watertown	10/1-12/31/79	1811	84	75	40	14	0	0
2640-012	Worcester Washington & New Salem Street	1/1-12/31/79	8307	149	119	72	13	0	0

TABLE 6

SULFUR DIOXIDE (SO_2)

state network data in ppb

1979 DATA

SITE	ADDRESS	PERIOD	NUMBER OF OBSERVATIONS	MAXIMUMS 1-hr.	3-hr	24-hr.	ARITHMETIC MEAN	EXCEEDANCES 3-hr. over 500ppb	24-hr. over 140
120-003	Attleboro	1/1-12/26/79	7198	69	67	35	7.0	0	0
240-002	Boston Kenmore Square	1/1-12/31/79	7924	199	119	65	19.0	0	0
240-016	Boston Callahan Tunnel	1/12-12/31/79	7451	108	88	49	10.0	0	0
400-005	Chicopee Chicopee Street	1/1-12/31/79	8222	138	93	60	12.0	0	0
580-004	Fall River	1/1-12/31/79	6373	278	198	63	12.0	0	0
620-003	Fitchburg Gas & Substation Summer Street	1/1-12/31/79	7459	99	95	49	11.0	0	0
000-003	Lawrence Lawrence General Hospital	1/1-12/31/79	6847	185	127	81	16.5	0	0
080-004	Lowell John Street Municipal Garage	1/1-12/31/79	8019	100	83	49	10.0	0	0
210-001	Medfield State Hospital	1/2-12/21/79	8095	98	98	48	7.0	0	0
220-003	Medford Wellington Circle	1/1-12/31/79	7804	123	110	58	12.0	0	0
300-005	Pittsfield	1/1-12/30/79	8096	112	104	47	8.0	0	0

SULFUR DIOXIDE (SO_2)
private network data in ppb

1979 DATA

SITE	ADDRESS	PERIOD	NUMBER OF OBSERVATIONS	MAXIMUMS 1-hr.	3-hr.	24-hr.	ARITHMETIC MEAN	EXCEEDANCES 3-hr over 500ppb	24-hr. over 140p
0220-001	Beverly	1/1-12/31/79	7263	131	99	47	7	0	0
0240-018	Boston	1/1-12/31/79	8462	124	109	64	16	0	0
0240-019	Boston	1/1-12/31/79	8295	118	93	52	10	0	0
0240-020	Boston	1/1-12/31/79	8549	188	149	69	14	0	0
0240-021	Boston	1/1-12/31/79	8488	159	146	90	19	0	0
0470-001	Dalton	1/1-12/31/79	8191	60	53	27	3	0	0
0470-003	Dalton	1/1-4/15/79	2372	75	62	30	7	0	0
0480-001	Danvers	1/1-12/31/79	7189	117	94	44	11	0	0
0580-007	Fall River	4/1-5/31/79	1421	194	113	26	8	0	0
0580-007	Fall River	1/1-12/31/79	7143	327	199	45	9	0	0
0580-009	Fall River	1/1-12/31/79	7369	194	169	94	14	0	0
0580-010	Fall River	1/1-12/31/79	7923	263	227	114	11	0	0
0580-012	Fall River	1/1-1/31/79	739	152	123	48	16	0	0
		2/1-12/31/79	7901	309	217	48	10	0	0
0620-007	Fitchburg	1/1-12/31/79	7465	100	72	45	10	0	0
0620-008	Fitchburg	1/1-12/31/79	6189	115	84	39	9	0	0
0620-009	Fitchburg	1/1-12/31/79	6814	155	123	69	15	0	0
0789-001	Hadley	1/1-12/31/79	8150	111	88	55	11	0	0
0789-002	Hadley	1/1-12/31/79	7805	150	76	50	11	0	0
0860-005	Holyoke	1/1-12/31/79	8328	114	84	43	10	0	0

TABLE 7
page II

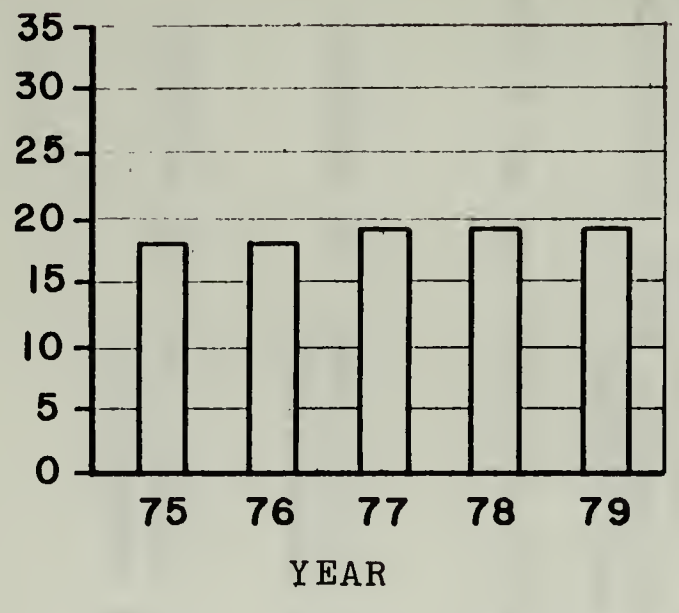
SULFUR DIOXIDE (SO_2)
private network data in ppb

1979 DATA

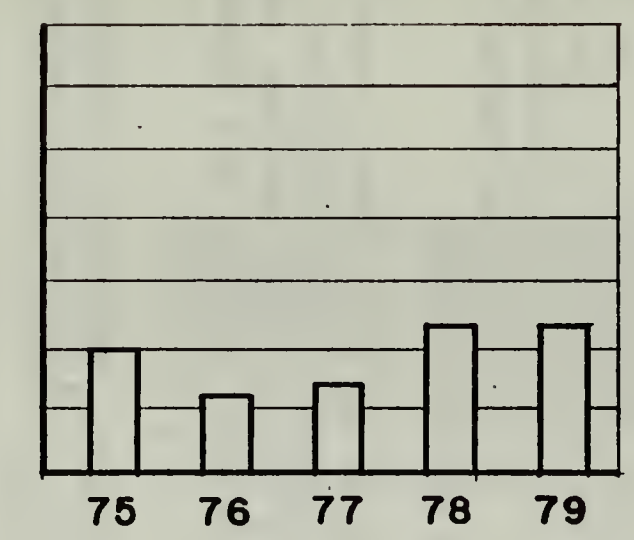
SITE	ADDRESS	PERIOD	NUMBER OF OBSERVATIONS	MAXIMUMS 1-hr.	3-hr.	24-hr.	ARITHMETIC MEAN	EXCEEDANCES 3-hr. over 500ppb	24-hr over 140p
1020-002	Lee	1/1-9/27/79	4218	205	202	160	26	0	1
1020-003	Lee	7/7-7/31/79	529	75	55	31	18	0	0
1100-003	Lynn	1/12-12/31/79	6334	24	21	15	10	0	0
1160-003	Marblehead	1/1-12/31/79	7620	245	187	68	11	0	0
1384-001	Monroe	1/1-12/31/79	8374	189	131	48	7	0	0
1384-002	Monroe	1/3-2/4/79	673	82	74	31	12	0	0
1384-003	Monroe	1/1-2/5/79	845	71	59	24	8	0	0
1980-002	Salem	1/1-12/31/79	7567	138	115	65	10	0	0
2042-001	Sherborn	1/5-12/7/79	7075	57	48	28	7	0	0
2126-002	S. Hadley	1/1-12/31/79	8295	138	91	57	11	0	0
2160-009	Springfield	1/1-12/31/79	8048	219	207	112	19	0	0
2160-010	Springfield	1/1-12/31/79	7165	150	109	58	15	0	0
2230-001	Swansea	1/1-12/31/79	6512	373	289	82	10	0	0
2420-001	Wellesley	5/21-12/31/79	4723	140	113	68	8	0	0
2475-002	W. Springfield	1/1-12/31/79	8394	275	258	116	13	0	0

FIGURE 7A

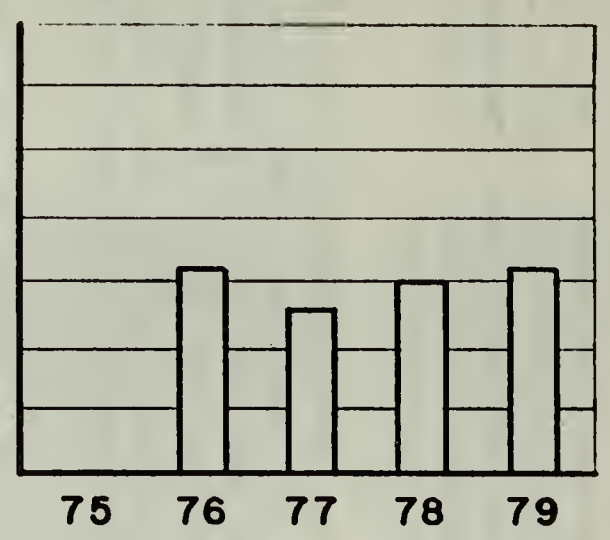
SULFUR DIOXIDE HISTORY AT SELECTED SITES (ppb)



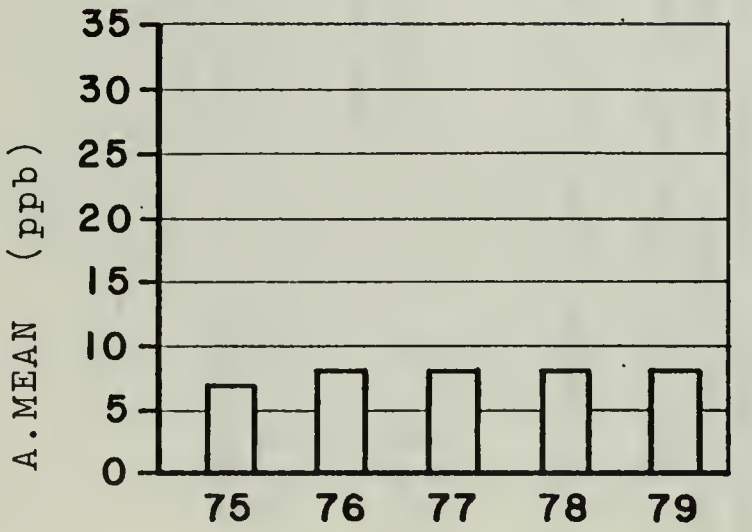
0240-002 BOSTON



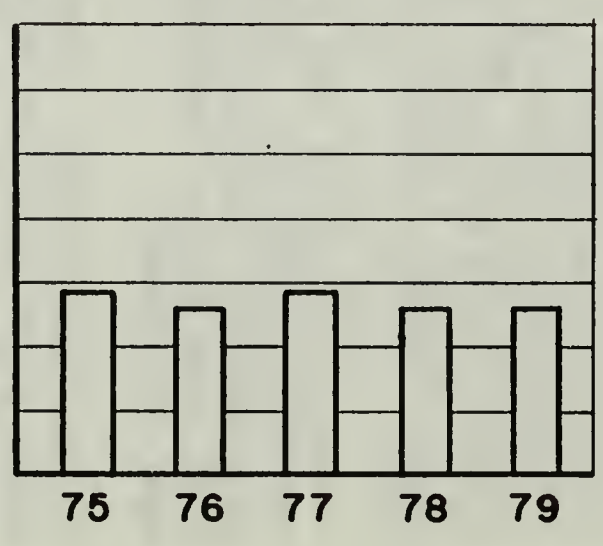
0580-004 FALL RIVER



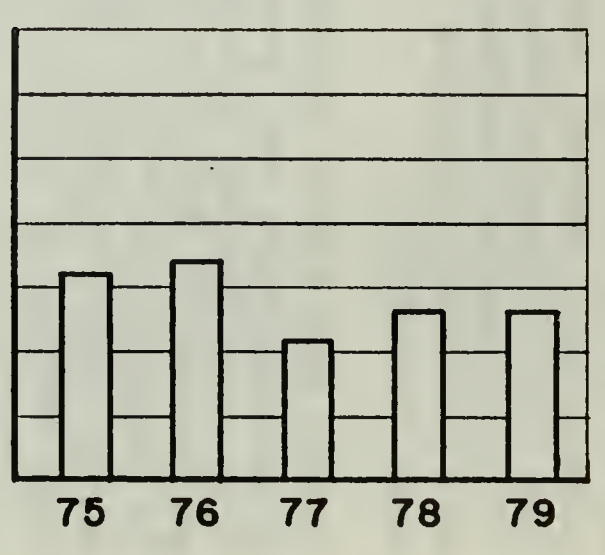
1000-003 LAWRENCE



1800-004 PITTSFIELD



2160-005 SPRINGFIELD



2640-017 WORCESTER

Ozone (O_3) is a highly reactive oxidant gas, which has a pungent odor and a faintly bluish tint. It is a poisonous form of pure oxygen and is the principal component of smog. Until recently the Environmental Protection Agency called this type of pollution "Photochemical oxidants." The name was changed because ozone was the only oxidant actually measured and was, by far, the most plentiful.

Ozone and other oxidants, including peroxyacetal nitrates (PAN), formaldehydes and peroxides, are not emitted into the air directly. They are formed by chemical reactions in the air from two other pollutants: hydrocarbons and nitrogen oxides. Energy from sunlight is needed for these chemical reactions; hence the term photochemical smog with itsdaily variations, increasing during the day and decreasing at night.

Ozone is produced from both natural and man-made activity. In the upper atmosphere, the stratosphere, ozone is produced naturally in the presence of oxygen, nitrogen oxides and intense ultra-violet radiation. Substantial amounts of ozone, from this stratospheric layer, occasionally enters the lower atmosphere, the troposphere, by natural processes. Ozone is produced also in the troposhere from the natural emissions of hydrocarbons and nitrogen oxides. Usually the highest levels of O3, in the troposphere, however, are found some distance downwind from urban areas.

Ozone irritates the mucous membranes of the respiratory system causing coughing, choking and decreased lung function. It aggravates chronic respiratory diseases like asthma and bronchitis. PAN, and other oxidants that accompany ozone, are powerful eye irritants.

Ozone can damage vegetables - lettuce, cabbage, tobacco and spinach seem particularly susceptible. The pollutant can also weaken materials such as rubber and fabrics.

The Massachusetts Division of Air Quality Control, with the American Lung Associations of Massachusetts, has established an air quality Pollutant Standard Index (PSI). The PSI was established in order to give those citizens of Massachusetts with respiratory problems a way of planning their day's activities.

The index, description and health effects are as follows:

0 to 50
Good: within federal guidelines for safety; no precautions necessary

50 to 100
Moderate: within federal guidelines for safety; no precautions necessary

101 to 200 Unhealthful:	mild aggravation of symptoms in susceptible persons, irritational symptoms in healthy population; reduction of physical or outdoor activities for those with existing heart or respiratory ailments
201 to 300 Very Unhealthful:	significant aggravation of symptoms and decreased exercise tolerance among those with lung or heart disease, widespread symptoms among healthy population; elderly and persons with existing heart and lung disease should remain indoors and reduce activity
301 to 500 Hazardous	premature onset of certain diseases in addition to significant aggravation of symptoms and decreased exercise tolerance among the healthy; elderly and those with existing diseases should stay inactive and indoors, general public should avoid outdoor activity. Any index reading between the 400 and 500 level would bring premature death of the ill and elderly, and normally healthy people would be adversely affected in their activities. At this level <u>everyone</u> should remain indoors - behind closed doors and windows.

The state and federal ozone standard is:

one-hour standard:	primary and secondary	120ppb*

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* ppb- parts per billion

Data Interpretation: Ozone

The Clean Air Act allows the ozone standards to be exceeded more than once a year per site if the exceedances occur on the same day. In other words, when consulting the state's 1979 ozone data in Table 8, one should direct their attention to the last column - "Number of Days Over 120 ppb". This is the relevant information when determining whether the ozone standards were violated.

All the monitoring stations recorded at least one day in which the ozone standard was exceeded (Table 8). Gardner, Pittsfield and Worcester (Washington and New Salem Streets monitor) were the only stations in Massachusetts with only one day in exceedance. Agawam had the most number of hours (30) in exceedance of the standard. Lincoln and Gardner had the highest ozone levels recorded (220 ppb) at almost twice the O_3 standard (120ppb). Georgetown and Lincoln recorded the most number of days in exceedance of the O_3 standard (7 separate days).

Figure 9 reflects the ozone trends in Medford , Quincy and Pittsfield. Medford and Quincy recorded an increase, from 1978, in the number of days above 120 ppb. Quincy and Pittsfield recorded a decrease, from 1978, in the number of days with an ozone maximum between 80 and 120 ppb. Generally, Medford's trend chart reflects no great improvement in the control of ozone exceedances. Quincy has seen a downward trend since 1977. Pittsfield's exceedances have stablized during 1977, 1978 and 1979.

The Commonwealth is not only concerned with decreasing the number of days which exceedances occur but with the severity of the exceedance. The entire Commonwealth of Massachusetts is considered to be in violation of the ozone standards (a non-attainment area for ozone). The question of how much of the ozone problem is imported from downwind states is an important point Massachusetts is actively investigating.

The Department of Environmental Quality Engineering's Division of Air Quality Control and Massachusetts' regional planning agencies are developing transportation control strategies (such as the inspection and maintenance program for automobile emissions) in an attempt to control this pollutant.

OZONE (Oz)
state network data in ppb

1979 DATA

SITE	ADDRESS	PERIOD	NUMBER OF OBSERVATIONS	MAXIMUMS 1st	2nd	3rd	NUMBER OF HOURS EXCEEDING 120 PPB	NUMBER OF DAY EXCEEDING 120 PPB
0030-002	Agawam	4/20 - 10/31/79	4405	175	165	160	30	5
0060-001	Amherst U. Mass.	4/1 - 10/23/79	4125	152	143	135	13	6
0120-003	Attleboro La Sallette Shrine & Park Street	4/2 - 10/31/79	4677	149	137	136	11	4
0372-001	Charlton	5/7 - 10/31/79	3912	195	185	150	20	4
0720-002	Gardner	5/3 - 8/10/79	2227	142	138	130	8	1
0730-001	Georgetown High School	4/1 - 12/31/79	6171	191	185	155	21	7
0740-001	Gloucester	4/1 - 10/31/79	4357	165	158	150	12	3
0780-002	Greenfield	4/1 - 10/11/79	3581	150	150	140	6	2
1065-001	Lincoln	4/5 - 10/31/79	4453	220	216	200	23	7
1210-001	Medfield State Hospital	4/1 - 10/31/79	4845	182	167	166	17	5
1220-003	Medford Wellington Circle	4/1 - 10/31/79	4801	145	140	130	8	6
1800-005	Pittsfield	1/16 - 10/9/79	4323	150	135	120	2	1

TABLE 8
page II

OZONE (O_3)
state network data in ppb

SITE	ADDRESS	PERIOD	NUMBER OF OBSERVATIONS	1979 DATA MAXIMUMS 1st	2nd	3rd	NUMBER OF HOURS EXCEEDING 120 PPB	NUMBER OF DAYS EXCEEDIN 120 PPB
1880-002	Quincy Fore River Bridge	4/1 - 10/31/79	4154	160	155	150	14	5
2640-012	Worcester Washington & New Salem Streets	4/28 - 9/18/79	2991	128	120	115	1	1
2640-015	Worcester	5/7 - 11/7/79	4213	220	185	170	9	4

FIGURE 9

OZONE HISTORY AT SELECTED SITES